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| For: METHOD AND APPARATUS FOR    | ) |                       |
| DATA-DRIVING ELECTROLUMINESCENCE | ) |                       |
| DISPLAY PANEL DEVICE             | ) |                       |

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I, the below named translator, hereby declare that:

My name and post office address are as stated below;

That I am knowledgeable in the English language and in the Korean language and believe the attached English translation to be a true and complete translation of the below identified document; and


The document for which the attached English translation is being submitted is Korean Patent Application No. 2002-0051087 filed in Korea on August 28, 2002. The Korean language document was submitted to the U.S. Patent and Trademark Office on June 27, 2003 as the certified copy of the foreign priority application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Date: March 28, 2006



# **STATUTORY DECLARATION**

I, Kyung Gu KANG, a citizen of the Republic of Korea and a staff member of Y.H.KIM INTERNATIONAL PATENT & LAW OFFICE specializing in "APPARATUS FOR DRIVING DATA OF ELECTRO-LUMINESCENCE DISPLAY PANEL" do hereby declare that:

I am conversant with the English and Korean languages and a competent translator thereof.

To the best of my knowledge and belief, the following is a true and correct translation of the Relativity Document (No. P2002-51087) in the Korean language already filed with Korean Industrial Property Office on August 28, 2002.

Signed this 28th day of March, 2006

Kyung Gu KANG

**PATENT APPLICATION**

**DOCUMENT NAME:** PATENT APPLICATION

**TO:** COMMISSIONER

**DATE:** August 28, 2002

**TITLE OF THE INVENTION:** APPARATUS FOR DRIVING DATA OF ELECTRO-  
LUMINESCENCE DISPLAY PANEL

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The present application is filed pursuant to Article 42 of the  
Korea Patent Act.

Patent Attorney

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## [ABSTRACTS]

### [ABSTRACT]

There is disclosed a data-driving apparatus and method of an electro luminescence display panel that is adaptive for reducing output deviations between data drive IC's.

A data-driving apparatus of an electro luminescence display panel according to an embodiment of the present invention includes a display panel including a plurality of scan electrode lines and data electrode lines crossing each other, and a plurality of electro-luminescence cells including a current mirror circuit and emitted by a current; a plurality of current sink type data drive integrated circuits integrated a reference current supply/path part including a plurality of current sink type data drives for supplying the data to the display panel on the basis of the constant current, a first switching device connected between a first voltage source and the ground voltage source, a second and third switching device for forming a current mirror circuit with the first switching device to supply a reference current to the data driver, a fourth switching device supplied with a second voltage source and connected to the second switching device, and a fifth switching device supplied with the second voltage source and for forming a current mirror circuit with the fourth switching device to

output the reference current; and wherein the data drive integrated circuits are supplied with the reference current from the five switching device, and the reference current supply/path part is formed at one side of the data drive integrated circuit.

**[REPRESENTATIVE DRAWING]**

Fig. 6

**[SPECIFICATION]**

**[TITLE OF THE INVENTION]**

APPARATUS FOR DRIVING DATA OF ELECTRO-LUMINESCENCE DISPLAY  
PANEL

**[BRIEF DESCRIPTION OF THE DRAWINGS]**

Fig. 1 is a section view illustrating a structure of a general organic electro luminescence device;

Fig. 2 is a diagram illustrating an active matrix type electro luminescence display apparatus according to the related art;

Fig. 3 is a diagram illustrating a detailed configuration of a data driver shown in Fig. 2;

Fig. 4 is a diagram illustrating an active matrix type electro luminescence display apparatus according to the present invention;

Fig. 5 is a diagram representing a cell of an electro luminescence display panel shown in Fig. 4 in detail;

Fig. 6 is a diagram representing a configuration of a data driver according to a first embodiment of the present invention;

Fig. 7 is a diagram briefly representing a current sink data drive IC part shown in Fig. 6;

Fig. 8 is a diagram representing the current sink data drive IC part shown in Fig. 6 in detail;

Fig. 9 is a diagram representing a configuration of a data driver according to a second embodiment of the present invention;

Fig. 10 is a diagram briefly representing a current sink data drive IC part shown in Fig. 9;

Fig. 11 is a diagram representing the current sink data drive IC part shown in Fig. 9 in detail;

Fig. 12 is a diagram illustrating another active matrix type electro luminescence display apparatus according to the present invention;

Fig. 13 is a diagram representing a cell of an electro luminescence display panel shown in Fig. 12 in detail;

Fig. 14 is a diagram representing a configuration of a data driver according to a third embodiment of the present invention;

Fig. 15 is a diagram briefly representing a current source data drive IC part shown in FIG. 14;

Fig. 16 is a diagram representing the current source data drive IC part shown in Fig. 14 in detail;

Fig. 17 is a diagram representing a configuration of a data driver according to a fourth embodiment of the present invention;



Fig. 18 is a diagram briefly representing a current source data drive IC part shown in Fig. 17; and

Fig. 19 is a diagram representing the current source data drive IC part shown in Fig. 17 in detail.

**<DETAILED DESCRIPTION OF THE REFERENCE NUMERALS>**

|  |                              |
|--|------------------------------|
| 2: cathode electrode                                   | 4: electron injection layer  |
| 6: electron transport layer                            | 8: light emission layer      |
| 10: hole transport layer                               | 12: hole injection layer     |
| 14: anode  | 16, 42, 62: EL display panel |
| 18, 44, 64: scan driver                                | 20, 46, 66: data driver      |
| 21: data drive IC                                      | 22, 48, 68: organic EL cell  |
| 50, 70: cell driver                                    |                              |
| 52, 56, 72, 76: current sink data drive IC             |                              |
| 54A, 58A, 74A, 78A: reference current supply/path part |                              |
| 54B, 58B, 74B, 78B: current sink type data drive IC    |                              |

**[DETAILED DESCRIPTION OF THE INVENTION]**

**[OBJECT OF THE INVENTION]**

**[TECHNICAL FIELD INCLUDING THE INVENTION AND PRIOR ART THEREIN]**

The present invention relates to an electro luminescence display panel, and more particularly to a data-driving apparatus and method of an electro luminescence display panel

that is adaptive for reducing output deviations between data drive IC's.

Recently, there have been developed various flat panel displays with their weight and bulk reduced, which is the disadvantage of a cathode ray tube CRT. Such flat panel displays include a liquid crystal display LCD, a field emission display FED, a plasma display panel PDP, and an electro luminescence EL display apparatus. The flat panel displays can be classified into voltage drive devices and current drive devices.

The EL display apparatus is generally classified into an inorganic EL and an organic EL in accordance with its material and structure, and the EL display apparatus is a self-luminous device that has fluorescent material emit light by recombining electrons with holes. The EL display apparatus has an advantage in that its response speed is as fast as the cathode ray tube in comparison with a passive type luminous device that requires a separate light source like the liquid crystal display. Such an EL display apparatus has a current drive type and a voltage drive type.

Fig. 1 is a section view illustrating a general organic EL structure for explaining the luminous principle of an EL display apparatus. The organic EL includes an electron injection layer 4, an electron transport layer 6, a light

emission layer 8, a hole transport layer 10 and a hole injection layer 12 that are deposited between a cathode 2 and an anode 14.

If a voltage is applied between the anode electrode 14 of transparent electrode and the cathode electrode 2 of metal electrode, electrons generated from the cathode 2 move toward the light emission layer 8 through the electron injection layer 4 and the electron transport layer 6. Further, holes generated from the anode 14 move toward the light emission layer 8 through the hole injection layer 12 and the hole transport layer 10. Accordingly, the electrons and the holes supplied from the electron transport layer 6 and the hole transport layer 10 are collided in the light emission layer 8 to be re-combined, thereby generating light. The generated light is emitted through the anode 14 to the outside to display a picture. The luminous brightness of such an EL organic device is not proportional to a voltage applied at both ends of the device, but proportional to a supply current, thus the anode 14 is normally connected to a constant current source.

Fig. 2 is a diagram illustrating an active matrix type EL display apparatus according to the related art.

Referring to Fig. 2, the active matrix type EL display apparatus according to the related art includes an EL display

panel 16 having an organic EL (hereinafter, referred to as OEL) cells 22 arranged at each intersection part of scan lines SL and data lines DL, a scan driver 18 to drive the scan lines SL, and a data driver 20 to drive the data lines DL.

Each organic EL cell 22 is selected when scan pulses are applied to the scan line SL of cathode to generate a light corresponding to a pixel signal, i.e., a current signal, supplied to the data line DL of anode. The organic EL cell 22 includes an electro luminescence cell (hereinafter, referred to as OEL cell) and a cell driver. Each OEL cell may be equivalently expressed as a diode connected between the data line DL and the scan line SL. Each OEL cell emits light when a negative scan pulse is applied to the scan line SL and, at the same time, a positive current is applied to the data line DL in accordance with a data signal, so a forward voltage is applied. Differently from this, a reverse voltage is applied to the OEL cell included in an unselected scan line, thus no light is emitted. In other words, the light-emitting OEL cell is charged with a forward charge, whereas the OEL cell with no light emission is charged with a reverse charge.

The scan driver 18 sequentially supplies the negative scan pulse to scan lines SL.

The data driver 20 supplies a current signal to the data lines DL, wherein the current signal has a current level or

pulse width corresponding to a data signal for each horizontal period.

In this way, the EL display apparatus supplies the current signal with the current level or pulse width proportional to input data, to the OEL cell. And, each OEL cell emits light in proportion to the amount of current applied from the data line DL.

Herein, the data driver 20 controlling the pulse width of the current signal in response to the input data, as shown in Fig. 3, includes a plurality of data drive integrated circuits (hereinafter, referred to as IC), and the data drive IC 21 mainly uses a current mirror circuit in order to make a constant current.

Referring to Fig. 3, the data driver IC 21 includes a reference MOSFET M0 connected between a voltage source VDD and a ground voltage source, and the constant current sources, i.e., constant current supply MOSFET's M1 to M4 that are connected to the voltage source VDD and, at the same time, connected in parallel to the reference MOSFET M0 to form a current mirror circuit for applying the constant current (i) to each data line connected to the OEL cell 24. Further, the data drive IC 21 includes switch devices S1 to S4 that are connected between the constant current supply MOSFET M1 to M4 and the data line to control the supply time of the constant

current (i) from the constant supply MOSFET M1 to M4 in response to the input data, thereby controlling the pulse width of the current signal. At this moment, it is possible for the data drive IC 21 to include the switch devices (not shown).

Each of the constant current supply MOSFET's M1 to M4 together with the reference MOSFET M0 receiving the supply voltage of the voltage source VDD in parallel forms a current mirror circuit with the reference MOSFET M0, so the same amount of constant current (i) or  $2n$  times of the constant current  $2i$ ,  $4i$ ,  $8i$  and so on is supplied. The constant current (i) supplied from the constant current supply MOSFET's M1 to M4 becomes different in accordance with the amount of load, i.e., the line resistance of the data lines and a capacitance that has a close relationship with the amount of light emission of the OEL cell 24 owing to the structure of the EL display panel. Accordingly, the data drive IC 21 forming a current mirror circuit includes a plurality of current control resistors with a resistance value different from each other at the outside thereof in order to control the changing current in accordance with the amount of load. And, any one resistor R is selected among a plurality of current control resistors in accordance with the average amount of load of the data drive IC 21 to be connected between the reference MOSFET M0 and the

ground, thereby controlling the constant current (i) of the data drive IC 21.

The data driver 20 of the related art includes a plurality of data drive IC's 21 shown in Fig. 3, and an additional reference current source to the external voltage source is required for each data drive IC 21 to supply the reference current to the reference MOSFET M0. In this case, the output of each reference current source needs to be equal in order to reduce the current output deviation between the data drive IC's 21. At this moment, each data drive IC 21 uses the same external voltage source VDD, thus each current source needs to be adjusted for making the reference current equal.

However, the active matrix type EL display apparatus according to the related art has problems in that the number of reference current sources increases and more operational time is required to adjust these reference current sources in case that a plurality of data drive IC's 21 are used.

**[TECHNICAL SUBJECT MATTER TO BE SOLVED BY THE INVENTION]**

Accordingly, it is an object of the present invention to provide a data-driving apparatus and method of an electro luminescence display panel that is adaptive for reducing output deviations between data drive IC's.

It is another object of the present invention to provide

a data-driving apparatus and method of an electro luminescence display panel that is capable of reducing the control time of a current source from an external voltage source.

#### **[CONFIGURATION AND OPERATION OF THE INVENTION]**

In order to achieve these and other objects of the invention, a data-driving apparatus of an electro luminescence display panel according to an aspect of the present invention includes a display panel including a plurality of scan electrode lines and data electrode lines crossing each other, and a plurality of electro-luminescence cells including a current mirror circuit and emitted by a current;

a plurality of current sink type data drive integrated circuits integrated a reference current supply/path part including a plurality of current sink type data drives for supplying the data to the display panel on the basis of the constant current, a first switching device connected between a first voltage source and the ground voltage source, a second and third switching device for forming a current mirror circuit with the first switching device to supply a reference current to the data driver, a fourth switching device supplied with a second voltage source and connected to the second switching device, and a fifth switching device supplied with the second voltage source and for forming a current mirror



circuit with the fourth switching device to output the reference current; and wherein the data drive integrated circuits are supplied with the reference current from the five switching device, and the reference current supply/path part is formed at one side of the data drive integrated circuit.

The data driver includes: a constant current switching device supplied with a third voltage source and connected to the third switching device; and a plurality of constant current supply switching devices, each of which are connected to the ground voltage source to form a current mirror circuit with the constant current switching device for supplying the constant current to data lines of the panel by way of selecting switch devices corresponding to the constant current controlled in a  $2^n$  level through the constant current switching device.

The data driver further includes: switches connected between the constant current supply switching devices and the data lines for controlling the supply time of the constant current applied to the data lines in order to control a pulse width of a current signal.

The constant current switching device and the constant current supply switching device are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

The first to third switching devices are n-type Metal

Oxide Semiconductor Field Effect Transistor MOSFET's.

The fourth and fifth switching devices are p-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

A data-driving apparatus of an electro luminescence display panel according to an aspect of the present invention includes a display panel including a plurality of scan electrode lines and data electrode lines crossing each other, and a plurality of electro-luminescence cells including a current mirror circuit and emitted by a current;

a plurality of current sink type data drive integrated circuits including a plurality of current sink type data drivers for supplying the data to the display panel on the basis of the constant current, a first switching device connected between a first voltage source and the ground voltage source, a second switching device supplied with the first voltage source, and for forming a current mirror circuit with the first switching device, a third switching device connected between the second switching device and a ground voltage source, and controlled by a current controlling signal supplied by way of the second switching device, a fourth switching device formed a current mirror circuit with the third switching device to output a reference current, a fifth switching device formed a current mirror circuit with the third switching device to supply a reference current to the

data driver; the reference current from the fourth switching device is accessorially supplied to the data drive integrated circuits, and the reference current supply/path part is formed at one side of the data drive integrated circuit.

In the data-driving apparatus of the electro luminescence display panel, said first and second switching devices are p-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

In the data-driving apparatus of the electro luminescence display panel, said third to fifth switching devices are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

In the data-driving apparatus of the electro luminescence display panel, a fifth switching device is unified in the current sink type data drive integrated circuit.

In the data-driving apparatus of the electro luminescence display panel, said electro-luminescence cell includes an electro luminescence device OLED emitted by a current; a sixth switching device formed between a cell drive voltage source VDD and the electro luminescence device OLED for driving the electro luminescence device; a seventh switching device connected to the cell drive voltage source to form a current mirror with the sixth switching device; an eighth switching device connected the seventh switching device, the scan

electrode line and the data electrode line to respond to a signal of the data electrode line; a ninth switching device connected gate terminals of the sixth and seventh switching devices, the data electrode line and the eighth switching device; and a capacitor Cst connected between the cell drive voltage source VDD and the gate terminals of the sixth and seventh switching devices.

A data-driving apparatus of an electro luminescence display panel according to an embodiment of the present invention includes a display panel including a plurality of scan electrode lines and data electrode lines crossing each other, and a plurality of electro-luminescence cells including a current mirror circuit and emitted by a current;

a plurality of current source data drive integrated circuits integrated a reference current supply/path part including a plurality of current source data drivers for supplying the data to the display panel on the basis of the constant current, a first switching device connected between a first voltage source and the ground voltage source, a second and third switching device for forming a current mirror circuit with the first switching device to supply a reference current to the data driver, a fourth switching device supplied with a second voltage source and connected to the second switching device, and a fifth switching device supplied with

the second voltage source and for forming a current mirror circuit with the fourth switching device to output the reference current, and the reference current from the fifth switching device is accessorially supplied to the data drive integrated circuits, and the reference current supply/path part is formed at one side of the data drive integrated circuit.

In the data-driving apparatus of the electro luminescence display panel, said data driver includes a constant current switching device connected between the voltage source and the ground voltage source; and a plurality of constant current supply switching devices, each of which are connected to the voltage source to form a current mirror circuit with the constant current switching device for supplying the constant current to data lines of the panel by way of selecting switch devices corresponding to the constant current controlled in a  $2n$  level through the constant current switching device.

In the data-driving apparatus of the electro luminescence display panel, said data driver further includes switches connected between the constant current supply switching devices and the data lines for controlling the supply time of the constant current applied to the data lines in order to control a pulse width of a current signal.

In the data-driving apparatus of the electro luminescence

display panel, constant current switching device and the constant current supply switching device are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

In the data-driving apparatus of the electro luminescence display panel, said first to third switching devices are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

In the data-driving apparatus of the electro luminescence display panel, said fourth and fifth switching devices are p-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

A data-driving apparatus of an electro luminescence display panel according to an aspect of the present invention includes a display panel including a plurality of scan electrode lines and data electrode lines crossing each other, and a plurality of electro-luminescence cells including a current mirror circuit and emitted by a current;

a plurality of current source type data drive integrated circuits including a plurality of current source type data drivers for supplying the data to the display panel on the basis of the constant current, a first switching device connected between a first voltage source and the ground voltage source, a second switching device supplied with the first voltage source, and for forming a current mirror circuit

with the first switching device, a third switching device connected between the second switching device and a ground voltage source, and controlled by a current controlling signal supplied by way of the second switching device, a fourth switching device formed a current mirror circuit with the third switching device to output a reference current, a fifth switching device formed a current mirror circuit with the third switching device to supply a reference current to the data driver; the reference current from the fourth switching device is accessorily supplied to the data drive integrated circuits, and the reference current supply/path part is formed at one side of the data drive integrated circuit.

In the data-driving apparatus of the electro luminescence display panel, said first and second switching devices are p-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

In the data-driving apparatus of the electro luminescence display panel, said third to fifth switching devices are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

In the data-driving apparatus of the electro luminescence display panel, said electro-luminescence cell includes an electro luminescence device OLED emitted by a current; a sixth switching device formed between a ground voltage source GND

and the electro luminescence device OLED for driving the electro luminescence device; a seventh switching device connected to the ground voltage source GND to form a current mirror with the sixth switching device; an eighth switching device connected the seventh switching device, the scan electrode line and the data electrode line to respond to a signal of the data electrode line; a ninth switching device connected gate terminals of the sixth and seventh switching devices, the data electrode line and the eighth switching device; and a capacitor Cst connected between the ground voltage source GND and the gate terminals of the sixth and seventh switching devices.

These and other objects of the invention will be apparent from the following detailed description of the embodiments of the present invention with reference to the accompanying drawings, in which:

Hereinafter, the preferred embodiments of the present invention will be described in detail with reference to Figs. 4 to 19.

Fig. 4 is a diagram illustrating an active matrix type electro luminescence apparatus according to the present invention.

Referring to Fig. 4, the active matrix type electro luminescence display apparatus according to the present



invention includes an EL display panel 42 having a organic EL cell 48 arranged at each intersection part of scan lines SL and data lines DL, a scan driver 44 to drive the scan lines SL, and a data driver 46 to drive the data lines DL.

Each organic EL cell 48 is selected when scan pulses are applied to the scan line SL of cathode to generate a light corresponding to a pixel signal, i.e., a current signal, supplied to the data line DL of anode. Each OEL cell may be equivalently expressed as a diode connected between the data line DL and the scan line SL. Each OEL cell emits light when a negative scan pulse is applied to the scan line SL and, at the same time, a positive current is applied to the data line DL in accordance with a data signal, so a forward voltage is applied. Differently from this, a reverse voltage is applied to the OEL cell included in an unselected scan line, thus no light is emitted. In other words, the light-emitting OEL cell is charged with a forward charge, whereas the OEL cell with no light emission is charged with a reverse charge.

The scan driver 44 sequentially supplies the negative scan pulse to scan lines SL by lines.

The data driver 46 supplies a current signal to the data lines DL, wherein the current signal has a current level or pulse width corresponding to a data signal for each horizontal period.

In this way, the EL display apparatus supplies the current signal with the current level or pulse width proportional to input data, to the OEL cell. And, each OEL cell emits light in proportion to the amount of current applied from the data line DL.

Each organic EL cell 48, as shown in Fig. 5, includes a cell driver 50 and an electro luminescence cell (hereinafter, referred to as OEL cell). Herein, the cell driver 50 includes a first TFT T1 formed between a cell drive voltage source VDD and the OEL cell for driving the OEL cell; a second TFT T2 connected to the cell drive voltage source VDD to form a current mirror with the first TFT T1; a third TFT T3 connected to the second TFT T2, the scan line SL and the data DL for responding to a signal of the data line DL; a fourth TFT T4 connected to the gate terminals of the first TFT T1 and the second TFT T2, the scan line SL and the third TFT T3; and a capacitor Cst connected between the cell drive voltage source VDD and the gate terminals of the first TFT T1 and the second TFT T2. The first to fourth TFT T1 to T4 are p-type MOS-FET's.

The third and fourth TFT's T3 and T4 are turned on in response to a negative scan voltage from the scan line SL, thus a current path is enabled to conduct current between the source terminal and the drain terminal of themselves, in addition, the third and fourth TFT's T3 and T4 remain at off

state when a voltage in the scan line SL is below the threshold voltage  $V_{th}$  of themselves. A data voltage  $V_{cl}$  from the data line DL is applied to the gate terminal of the first TFT T1 through the third and fourth TFT's T3 and T4 during the on-time period of the third and fourth TFT's T3 and T4. On the contrary, each of the first and second TFT's T1 and T2 is open for the data voltage  $V_{cl}$  not to be applied to the first TFT T1 during the off-time period of the first and second TFT's T1 and T2.

The first TFT T1 controls the current between the source terminal and the drain terminal by the data voltage  $V_{cl}$  applied to the gate terminal of itself, so the OEL cell is made to emit light with a brightness corresponding to the data voltage  $V_{cl}$ .

The second TFT T2 is configured to form a current mirror with the first TFT T1, thereby uniformly controlling current at the first TFT T1.

The capacitor Cst stores a voltage difference between the data voltage  $V_{cl}$  and a cell drive voltage VDD to uniformly sustain the voltage applied to the gate terminal of the first TFT T1 for one frame period, and to uniformly sustain the current applied to the OEL cell for one frame period.

Herein, the data driver 46 controlling the pulse width of the current signal in response to the input data includes a

plurality of data drive IC.

Fig. 6 is a diagram representing a configuration of a data driver according to a first embodiment of the present invention. Fig. 7 is a diagram briefly representing a current sink data drive IC part shown in Fig. 6, and Fig. 8 is a diagram representing the current sink data drive IC part shown in Fig. 6 in detail.

Referring to Fig. 6 to Fig. 8, the data driver 46 includes a plurality of current sink data drive IC's 52A, 52B, 52C, ..., which are cascaded. Each of the current sink data drive IC's 52A, 52B, 52C, ... includes a reference current supply/path part 54A and a current sink type data drive IC 54B that is driven by a reference current from the reference current supply/path part 54A.

The reference current supply/path part 54A receives the reference constant current  $I_{ref}$  generated from the outside voltage source to apply the received current to the current sink type data drive IC 54B and, in addition, applies the same reference constant current ( $i$ ) to an adjacent current sink data drive IC part 52B. The reference current supply/path part 54A, as in the left side of FIG. 8, includes a first switching device D1 connected between a first voltage source VDD1 and a ground voltage source GND; second and third switching devices D2 and D3 connected to the ground voltage source GND to form a

current mirror circuit with the first switching device D1; a fourth switching device D4 connected between the second switching device D2 and a second voltage source VDD2; and a fifth switching device D5 connected to the second voltage source VDD2 to form a current mirror circuit with the fourth switching device D4 and, in addition, to transmit a reference current to the current sink data drive IC part 52B. At this moment, the third switching device D3 can be included within the current sink type data drive IC 54B. The first to third switching devices D1 to D3 are n-type MOS-FET's, and the fourth and fifth switching devices D4 and D5 are p-type MOS-FET's.

When looking at these operation, a reference current  $I_{ref}$  flows in the first switching device D1 in accordance with a current source using a first voltage source VDD1, and the same reference current  $I_{ref}$  flows in the second switching device D2 forming the current mirror with the first switching device D1. A current flows in the fourth switching device D4 connected to the second voltage source VDD2 and the second switching device D2 as much as the reference current  $I_{ref}$  flows through the second switching device D2. Accordingly, the same reference current  $I_{ref}$  flows in the fifth switching device D5 forming the current mirror with the fourth switching device D4, and the current is applied to the adjacent current sink data drive

IC part 52B. For this, the same current can be applied to all current sink type data drive IC's 54B within the data driver 46.

The current sink type data drive IC 54B, as in FIG. 8, includes a reference MOSFET M0 connected between a third voltage source VDD3 and the third switching device D3, and constant current sources, i.e., constant current supply MOSFET's M1 to M4, connected in parallel to the reference MOSFET M0 with the voltage source VDD to form a current mirror circuit for supplying a constant current (i) to each data line connected to the OEL cell. Further, the current sink type data drive IC 54B includes switch devices S1 to S4 that are connected between each of the constant current supply MOSFET's M1 to M4 and the data line to control the supply time of the constant current (i) from the constant current supply MOSFET M1 to M4 in response to input data, thereby controlling the pulse width of the current signal. At this moment, it is possible for the current sink type data drive IC 54B to include the switch devices (not shown).

Each of the constant current supply MOSFET's M1 to M4 together with the reference MOSFET M0 receiving the supply voltage of the ground voltage source GND in parallel forms a current mirror circuit with the reference MOSFET M0, so the same amount of constant current (i) or  $2n$  times of the

constant current  $2i$ ,  $4i$ ,  $8i$  and so on is supplied. The constant current ( $i$ ) supplied from the constant current supply MOSFET's M1 to M4 becomes different in accordance with the amount of load, i.e., the line resistance of the data lines and a capacitance that has a close relationship with the amount of light emission of the OEL cell owing to the structure of the EL display panel. Accordingly, the current sink type data drive IC 54B forming a current mirror circuit includes a plurality of current control resistors with a resistance value different from each other at the outside thereof in order to control the changing current in accordance with the amount of load. And, any one resistor R is selected among a plurality of current control resistors in accordance with the average amount of load of the current sink type data drive IC 54B to be connected between the reference MOSFET M0 and the ground, thereby controlling the constant current ( $i$ ) of the current sink type data drive IC 54B.

Fig. 9 is a diagram representing a configuration of a data driver according to the second embodiment of the present invention. Fig. 10 is a diagram briefly representing a current sink data drive IC part shown in Fig. 9, and Fig. 11 is a diagram representing the current sink data drive IC part shown in Fig. 9 in detail.

Referring to Fig. 9 to Fig. 11, the data driver 46

includes a plurality of current sink data drive IC's 56A, 56B, 56C, ..., which are cascaded. Each of the current sink data drive IC's 56A, 56B, 56C, ... includes a reference current supply/path part 58A and a current sink type data drive IC 58B that is driven by a reference current from the reference current supply/path part 58A.

The reference current supply/path part 58A receives the reference constant current  $I_{ref}$  generated from the ground voltage source to apply the received current to the current sink type data drive IC 58B and, in addition, applies the same reference constant current (i) to an adjacent current sink data drive IC part 56B. The reference current supply/path part 58A includes a first switching device D1 connected between a first voltage source VDD1 and a ground voltage source GND; a second switching device D2 connected to the first voltage source VDD1 to form a current mirror circuit with the first switching device D1; a third switching device D3 connected between the second switching device and the ground voltage source GND; a fourth switching device D4 connected to the ground voltage source GND to form a current mirror circuit with the third switching device D3 and, in addition, to transmit the reference current to the adjacent current sink data drive IC part 56B; and a fifth switching device D5 connected to the ground voltage source GND to form a current



mirror circuit with the third switching device D3 and, in addition, to supply the reference current to the current sink type data drive IC part 58B. At this moment, the fifth switching device D5 can be included within the current sink type data drive IC 58B. The first and second switching devices D1 and D2 are p-type MOS-FET's, and the third to fifth switching devices D3 to D5 are n-type MOS-FET's.

When looking at these operation, a reference current  $I_{ref}$  flows through the source-drain terminals of the first switching device D1 in accordance with the pulse width of a current signal using the ground voltage source GND, and the same reference current  $I_{ref}$  flows in the second switching device D2 forming the current mirror with the first switching device D1. The reference current  $I_{ref}$  via the second switching device D2 controls the gate terminal of the third switching device D3, thereby causing the same reference current  $I_{ref}$  to flow in the third switching device D3. Due to this, the same reference current  $I_{ref}$  flows in the fourth switching device D4 that forms the current mirror circuit with the third switching device D3, and the same reference current  $I_{ref}$  also flows in the adjacent current sink data drive IC 56B connected to the fourth switching device D4. The fifth switching device D5 forming the current mirror circuit with the third switching device D3 supplies the reference current  $I_{ref}$  into the current

sink type data drive IC 58B in the same manner as the third switching device D3. Owing to such a configuration, the same current can be applied to all current sink type data drive IC's 58B within the data driver 46.

The current sink type data drive IC 58B includes a reference MOSFET M0 connected between a second voltage source VDD2 and the fifth switching device D5, and constant current sources, i.e., constant current supply MOSFET's M1 to M4, connected in parallel to the reference MOSFET M0 with the voltage source VDD to form a current mirror circuit for supplying a constant current (i) to each data line connected to the OEL cell. Further, the current sink type data drive IC 58B includes switch devices S1 to S4 that are connected between each of the constant current supply MOSFET's M1 to M4 and the data line to control the supply time of the constant current (i) from the constant current supply MOSFET M1 to M4 in response to input data, thereby controlling the pulse width of the current signal. At this moment, it is possible for the current sink type data drive IC 58B to include the switch devices (not shown).

Each of the constant current supply MOSFET's M1 to M4 together with the reference MOSFET M0 receiving the supply voltage of the ground voltage source GND in parallel forms a current mirror circuit with the reference MOSFET M0, so the

same amount of constant current ( $i$ ) or  $2n$  times of the constant current  $2i$ ,  $4i$ ,  $8i$  and so on is supplied. The constant current ( $i$ ) supplied from the constant current supply MOSFET's M1 to M4 becomes different in accordance with the amount of load, i.e., the line resistance of the data lines and a capacitance that has a close relationship with the amount of light emission of the OEL cell owing to the structure of the EL display panel. Accordingly, the current sink type data drive IC 58B forming a current mirror circuit includes a plurality of current control resistors with a resistance value different from each other at the outside thereof in order to control the changing current in accordance with the amount of load. And, any one resistor R is selected among a plurality of current control resistors in accordance with the average amount of load of the current sink type data drive IC 58B to be connected between the reference MOSFET M0 and the ground, thereby controlling the constant current ( $i$ ) of the data drive IC 58.

Fig. 12 is a diagram illustrating another active matrix type EL display apparatus according to the present invention.

Referring to Fig. 12, the active matrix type EL display apparatus according to the present invention includes an EL display panel 62 having a organic EL cell 68 arranged at each intersection part of scan lines SL and data lines DL, a scan

driver 64 to drive the scan lines SL, and a data driver 66 to drive the data lines DL.

Each pixel is selected when scan pulses are applied to the scan line SL of cathode to generate a light corresponding to a pixel signal, i.e., a current signal, supplied to the data line DL of anode. Each pixel, as shown in FIG. 13, includes a cell driver 70 and an OEL cell. The OEL cell may be equivalently expressed as a diode connected between the data line DL and the scan line SL. Each OEL cell emits light when a negative scan pulse is applied to the scan line SL and, at the same time, a positive current is applied to the data line DL in accordance with a data signal, so a forward voltage is applied. Differently from this, a reverse voltage is applied to the OEL cell included in an unselected scan line, thus no light is emitted. In other words, the light-emitting OEL cell is charged with a forward charge, whereas the OEL cell with no light emission is charged with a reverse charge.

The scan driver 64 sequentially supplies the negative scan pulse to scan lines SL by lines.

The data driver 66 supplies a current signal to the data lines DL, wherein the current signal has a current level or pulse width corresponding to a data signal for each horizontal period.

In this way, the EL display apparatus supplies the

current signal with the current level or pulse width proportional to input data, to the OEL cell. And, each OEL cell emits light in proportion to the amount of current applied from the data line DL.

Each organic EL cell 48, as shown in Fig. 13, includes a cell driver 50 and an electro luminescence cell. Herein, the cell driver 70 includes a first TFT T1 formed between a ground voltage source GND and the OEL cell for driving the OEL cell; a second TFT T2 connected to the ground voltage source GND to form a current mirror with the first TFT T1; a third TFT T3 connected to the second TFT T2, the scan line SL and the data DL for responding to a signal of the data line DL; a fourth TFT T4 connected to the gate terminals of the first TFT T1 and the second TFT T2, the scan line SL and the third TFT T3; and a capacitor Cst connected between the ground voltage source GND and the gate terminals of the first TFT T1 and the second TFT T2. The first to fourth TFT T1 to T4 are n-type MOS-FET's.

The third and fourth TFT's T3 and T4 are turned on in response to a positive scan voltage from the scan line SL, thus a current path is enabled to conduct current between the source terminal and the drain terminal of themselves, in addition, the third and fourth TFT's T3 and T4 remain at off state when a voltage in the scan line SL is below the threshold voltage  $V_{th}$  of themselves. A data voltage  $V_{cl}$  from

the data line DL is applied to the gate terminal of the first TFT T1 through the third and fourth TFT's T3 and T4 during the on-time period of the third and fourth TFT's T3 and T4. On the contrary, each of the first and second TFT's T1 and T2 is open for the data voltage Vcl not to be applied to the first TFT T1 during the off-time period of the first and second TFT's T1 and T2.

The first TFT T1 controls the current between the source terminal and the drain terminal by the data voltage Vcl applied to the gate terminal of itself, so the OEL cell is made to emit light with a brightness corresponding to the data voltage Vcl by way of a voltage difference between the ground voltage source GND and the cell drive voltage source VDD. The second TFT T2 is configured to form a current mirror with the first TFT T1, thereby uniformly controlling current at the first TFT T1.

The capacitor Cst stores a voltage difference between the data voltage Vcl and the ground voltage source GND to uniformly sustain the voltage applied to the gate terminal of the first TFT T1 for one frame period, and to uniformly sustain the current applied to the OEL cell for one frame period.

Herein, the data driver 66 controlling the pulse width of the current signal in response to the input data includes a

plurality of data drive IC's.

Fig. 14 is a diagram representing a configuration of a data driver according to the third embodiment of the present invention. Fig. 15 is a diagram briefly representing a current source data drive IC part shown in Fig. 14, and Fig. 16 is a diagram representing the current source data drive IC part shown in Fig. 14 in detail.

Referring to Fig. 14 to Fig. 16, the data driver 66 includes a plurality of current source data drive IC's 72A, 72B, 72C, ..., which are cascaded. Each of the current source data drive IC's 72A, 72B, 72C, ... includes a reference current supply/path part 74A and a current sink type data drive IC 74B that is driven by a reference current from the reference current supply/path part 74A.

The reference current supply/path part 74A receives the reference constant current  $I_{ref}$  generated from the outside voltage source to apply the received current to the current sink type data drive IC 74B and, in addition, applies the same reference constant current (i) to an adjacent current source data drive IC part 72B. The reference current supply/path part 74A includes a first switching device D1 connected between a first voltage source VDD1 and a ground voltage source GND; second and third switching devices D2 and D3 connected to the ground voltage source GND to form a current mirror circuit

with the first switching device D1; a fourth switching device D4 connected between the second switching device D2 and a second voltage source VDD2; and a fifth switching device D5 connected to the second voltage source VDD2 to form a current mirror circuit with the fourth switching device D4 and, in addition, to transmit a reference current to the current source data drive IC part 72B. At this moment, the third switching device D3 can be included within the current sink type data drive IC 74B. The first to third switching devices D1 to D3 are n-type MOS-FET's, and the fourth and fifth switching devices D4 and D5 are p-type MOS-FET's.

When looking at these operation, a reference current  $I_{ref}$  flows in the first switching device D1 in accordance with a current source using a first voltage source VDD1, and the same reference current  $I_{ref}$  flows in the second switching device D2 forming the current mirror with the first switching device D1. A current flows in the fourth switching device D4 connected to the second voltage source VDD2 and the second switching device D2 as much as the reference current  $I_{ref}$  flows through the second switching device D2. The same reference current  $I_{ref}$  flows in the fifth switching device D5 forming the current mirror with the fourth switching device D4, and the current is applied to the adjacent current source data drive IC part 72B. For this, the same current can be applied to all current sink



type data drive IC's 74B within the data driver 66.

The current sink type data drive IC 74B includes a reference MOSFET M0 connected between a third voltage source VDD3 and the third switching device D3, and constant current sources, i.e., constant current supply MOSFET's M1 to M4, connected in parallel to the reference MOSFET M0 with the third voltage source VDD3 to form a current mirror circuit for supplying a constant current (i) to each data line connected to the OEL cell. Further, the current sink type data drive IC 74B includes switch devices S1 to S4 that are connected between each of the constant current supply MOSFET's M1 to M4 and the data line to control the supply time of the constant current (i) from the constant current supply MOSFET M1 to M4 in response to input data, thereby controlling the pulse width of the current signal. At this moment, it is possible for the current sink type data drive IC 74B to include the switch devices (not shown).

Each of the constant current supply MOSFET's M1 to M4 together with the reference MOSFET M0 receiving the supply voltage of the third voltage source VDD3 in parallel forms a current mirror circuit with the reference MOSFET M0, so the same amount of constant current (i) or  $2n$  times of the constant current  $2i$ ,  $4i$ ,  $8i$  and so on is supplied. The constant current (i) supplied from the constant current supply

MOSFET's M1 to M4 becomes different in accordance with the amount of load, i.e., the line resistance of the data lines and a capacitance that has a close relationship with the amount of light emission of the OEL cell owing to the structure of the EL display panel. Accordingly, the current sink type data drive IC 74B forming a current mirror circuit includes a plurality of current control resistors with a resistance value different from each other at the outside thereof in order to control the changing current in accordance with the amount of load. And, any one resistor R is selected among a plurality of current control resistors in accordance with the average amount of load of the current sink type data drive IC 74B to be connected between the reference MOSFET M0 and the ground, thereby controlling the constant current (i) of the current sink type data drive IC 74B.

Fig. 17 is a diagram representing a configuration of a data driver according to the fourth embodiment of the present invention. Fig. 18 is a diagram briefly representing a current source data drive IC part shown in Fig. 17, and Fig. 19 is a diagram representing the current source data drive IC part shown in Fig. 17 in detail.

Referring to Fig. 17 to Fig. 19, the data driver 66 includes a plurality of current source data drive IC's 76A, 76B, 76C, ..., which are cascaded. Each of the current source

data drive IC's 76A, 76B, 76C, ... includes a reference current supply/path part 78A and a current sink type data drive IC 78B that is driven by a reference current from the reference current supply/path part 78A.

The reference current supply/path part 78A receives the reference constant current  $I_{ref}$  generated from the ground voltage source GND to apply the received current to the current sink type data drive IC 78B and, in addition, applies the same reference constant current ( $i$ ) to an adjacent current source data drive IC part 76B. The reference current supply/path part 78A includes a first switching device D1 connected between a first voltage source VDD1 and a ground voltage source GND; a second switching device D2 connected to the first voltage source VDD1 to form a current mirror circuit with the first switching device D1; a third switching device D3 connected between the second switching device D2 and the ground voltage source GND; a fourth switching device D4 connected to the ground voltage source GND to form a current mirror circuit with the third switching device D3 and, in addition, to transmit the reference current to the adjacent current source data drive IC part 76B; and a fifth switching device D5 connected to the ground voltage source GND to form a current mirror circuit with the third switching device D3 and, in addition, to supply the reference current to the current

sink type data drive IC part 78B. At this moment, the fifth switching device D5 can be included within the current sink type data drive IC 78B. The first and second switching devices D1 and D2 are p-type MOS-FET's, the third to fifth switching devices D3 to D5 are p-type MOS-FET's, and the fourth to fifth switching devices D4 to D5 are n-type MOS-FET's.

When looking at these operation, a reference current  $I_{ref}$  flows through the source-drain terminals of the first switching device D1 in accordance with the pulse width of a current signal using the ground voltage source GND, and the same reference current  $I_{ref}$  flows in the second switching device D2 forming the current mirror with the first switching device D1. The reference current  $I_{ref}$  via the second switching device D2 controls the gate terminal of the third switching device D3, thereby causing the same reference current  $I_{ref}$  to flow in the third switching device D3. Due to this, the same reference current  $I_{ref}$  flows in the fourth switching device D4 that forms the current mirror circuit with the third switching device D3, and the same reference current  $I_{ref}$  also flows in the adjacent current source data drive IC 76B connected to the fourth switching device D4. The fifth switching device D5 forming the current mirror circuit with the third switching device D3 supplies the reference current  $I_{ref}$  into the current sink type data drive IC 78B in the same manner as the third

switching device D3. Owing to such a configuration, the same current can be applied to all current sink type data drive IC's 78B within the data driver 66.

The current sink type data drive IC 78B includes a reference MOSFET M0 connected between a second voltage source VDD2 and the fifth switching device D5, and constant current sources, i.e., constant current supply MOSFET's M1 to M4, connected in parallel to the reference MOSFET M0 with the second voltage source VDD2 to form a current mirror circuit for supplying a constant current (i) to each data line connected to the OEL cell. Further, the current sink type data drive IC 78B includes switch devices S1 to S4 that are connected between each of the constant current supply MOSFET's M1 to M4 and the data line to control the supply time of the constant current (i) from the constant current supply MOSFET M1 to M4 in response to input data, thereby controlling the pulse width of the current signal. At this moment, it is possible for the current sink type data drive IC 78B to include the switch devices (not shown).

Each of the constant current supply MOSFET's M1 to M4 together with the reference MOSFET M0 receiving the supply voltage of the third voltage source VDD3 in parallel forms a current mirror circuit with the reference MOSFET M0, so the same amount of constant current (i) or  $2n$  times of the

constant current  $2i$ ,  $4i$ ,  $8i$  and so on is supplied. The constant current ( $i$ ) supplied from the constant current supply MOSFET's M1 to M4 becomes different in accordance with the amount of load, i.e., the line resistance of the data lines and a capacitance that has a close relationship with the amount of light emission of the OEL cell owing to the structure of the EL display panel. Accordingly, the data drive IC 58 forming a current mirror circuit includes a plurality of current control resistors with a resistance value different from each other at the outside thereof in order to control the changing current in accordance with the amount of load. And, any one resistor R is selected among a plurality of current control resistors in accordance with the average amount of load of the data drive IC 58 to be connected between the reference MOSFET M0 and the ground, thereby controlling the constant current ( $i$ ) of the data drive IC 58.

Each of the constant current supply MOSFET's M1 to M4 together with the reference MOSFET M0 receiving the supply voltage of the second voltage source VDD2 in parallel forms a current mirror circuit with the reference MOSFET M0, so the same amount of constant current ( $i$ ) or  $2^n$  times of the constant current  $2i$ ,  $4i$ ,  $8i$  and so on is supplied. The constant current ( $i$ ) supplied from the constant current supply MOSFET's M1 to M4 becomes different in accordance with the

amount of load, i.e., the line resistance of the data lines and a capacitance that has a close relationship with the amount of light emission of the OEL cell owing to the structure of the EL display panel. Accordingly, the data drive IC 78 forming a current mirror circuit includes a plurality of current control resistors with a resistance value different from each other at the outside thereof in order to control the changing current in accordance with the amount of load. And, any one resistor R is selected among a plurality of current control resistors in accordance with the average amount of load of the data drive IC 78 to be connected between the reference MOSFET M0 and the ground, thereby controlling the constant current (i) of the data drive IC 78.

#### **[EFFECT OF THE INVENTION]**

As described above, the driving apparatus and method of the EL display panel of the present invention includes the reference current supply/path part within each data drive IC to equally supply the constant current from the external voltage source to all data drive IC within the data driver, thereby reducing the current output deviation between the data drive IC's. Accordingly, the driving apparatus and method of the EL display panel of the present invention can reduce used parts and the control time of the constant current source by

way of using a single current source. Also, a current output deviation is minimized, so that it becomes possible to solve a non-uniform brightness.

Although the present invention has been explained by the embodiments shown in the drawings described above, it should be understood to the ordinary skilled person in the art that the invention is not limited to the embodiments, but rather that various changes or modifications thereof are possible without departing from the spirit of the invention. Accordingly, the scope of the invention shall be determined only by the appended claims and their equivalents.



**What is claimed is:**

1. A data-driving apparatus of an electro luminescence display panel, comprising:

a display panel including a plurality of scan electrode lines and data electrode lines crossing each other, and a plurality of electro-luminescence cells including a current mirror circuit and emitted by a current;

a plurality of current sink type data drive integrated circuits integrated a reference current supply/path part including a plurality of current sink type data drives for supplying the data to the display panel on the basis of the constant current, a first switching device connected between a first voltage source and the ground voltage source, a second and third switching device for forming a current mirror circuit with the first switching device to supply a reference current to the data driver, a fourth switching device supplied with a second voltage source and connected to the second switching device, and a fifth switching device supplied with the second voltage source and for forming a current mirror circuit with the fourth switching device to output the reference current; and

wherein the data drive integrated circuits are supplied with the reference current from the five switching device, and

the reference current supply/path part is formed at one side of the data drive integrated circuit.

2. The data-driving apparatus of the electro luminescence display panel as claimed in claim 1, wherein said data driver includes a constant current switching device supplied with a third voltage source and connected to the third switching device; and

a plurality of constant current supply switching devices, each of which are connected to the ground voltage source to form a current mirror circuit with the constant current switching device for supplying the constant current to data lines of the panel by way of selecting switch devices corresponding to the constant current controlled in a  $2n$  level through the constant current switching device.

3. The data-driving apparatus of the electro luminescence display panel as claimed in claim 2, wherein said data driver further includes switches connected between the constant current supply switching devices and the data lines for controlling the supply time of the constant current applied to the data lines in order to control a pulse width of a current signal.

4. The data-driving apparatus of the electro luminescence display panel as claimed in claim 2, wherein constant current switching device and the constant current supply switching device are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

6. The data-driving apparatus of the electro luminescence display panel as claimed in claim 1, wherein said first to third switching devices are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

7. The data-driving apparatus of the electro luminescence display panel as claimed in claim 1, wherein said fourth and fifth switching devices are p-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

9. A data-driving apparatus of an electro luminescence display panel, comprising:

a display panel including a plurality of scan electrode lines and data electrode lines crossing each other, and a plurality of electro-luminescence cells including a current mirror circuit and emitted by a current;

a plurality of current sink type data drive integrated circuits including a plurality of current sink type data

drivers for supplying the data to the display panel on the basis of the constant current, a first switching device connected between a first voltage source and the ground voltage source, a second switching device supplied with the first voltage source, and for forming a current mirror circuit with the first switching device, a third switching device connected between the second switching device and a ground voltage source, and controlled by a current controlling signal supplied by way of the second switching device, a fourth switching device formed a current mirror circuit with the third switching device to output a reference current, a fifth switching device formed a current mirror circuit with the third switching device to supply a reference current to the data driver; and

the reference current from the fourth switching device is accessorily supplied to the data drive integrated circuits, and the reference current supply/path part is formed at one side of the data drive integrated circuit.

10. The data-driving apparatus of the electro luminescence display panel as claimed in claim 9, wherein said first and second switching devices are p-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

11. The data-driving apparatus of the electro luminescence display panel as claimed in claim 9, wherein said third to fifth switching devices are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

12. The data-driving apparatus of the electro luminescence display panel as claimed in claim 9, wherein a fifth switching device is unified in the current sink type data drive integrated circuit.

13. The data-driving apparatus of the electro luminescence display panel as claimed in any one of claim 1 or claim 9, wherein said electro-luminescence cell includes:

an electro luminescence device OLED emitted by a current;

a sixth switching device formed between a cell drive voltage source VDD and the electro luminescence device OLED for driving the electro luminescence device;

a seventh switching device connected to the cell drive voltage source to form a current mirror with the sixth switching device;

an eighth switching device connected the seventh switching device, the scan electrode line and the data electrode line to respond to a signal of the data electrode line;

a ninth switching device connected gate terminals of the sixth and seventh switching devices, the data electrode line and the eighth switching device; and

a capacitor Cst connected between the cell drive voltage source VDD and the gate terminals of the sixth and seventh switching devices.

14. A data-driving apparatus of an electro luminescence display panel, comprising:

a display panel including a plurality of scan electrode lines and data electrode lines crossing each other, and a plurality of electro-luminescence cells including a current mirror circuit and emitted by a current;

a plurality of current source data drive integrated circuits integrated a reference current supply/path part including a plurality of current source data drivers for supplying the data to the display panel on the basis of the constant current, a first switching device connected between a first voltage source and the ground voltage source, a second and third switching device for forming a current mirror circuit with the first switching device to supply a reference current to the data driver, a fourth switching device supplied with a second voltage source and connected to the second switching device, and a fifth switching device supplied with

the second voltage source and for forming a current mirror circuit with the fourth switching device to output the reference current; and

the reference current from the fifth switching device is accessorially supplied to the data drive integrated circuits, and the reference current supply/path part is formed at one side of the data drive integrated circuit.

15. The data-driving apparatus of the electro luminescence display panel as claimed in claim 14, wherein said data driver includes a constant current switching device connected between the voltage source and the ground voltage source; and

a plurality of constant current supply switching devices, each of which are connected to the voltage source to form a current mirror circuit with the constant current switching device for supplying the constant current to data lines of the panel by way of selecting switch devices corresponding to the constant current controlled in a  $2^n$  level through the constant current switching device.

16. The data-driving apparatus of the electro luminescence display panel as claimed in claim 15, wherein said data driver further includes switches connected between the constant current supply switching devices and the data lines for

controlling the supply time of the constant current applied to the data lines in order to control a pulse width of a current signal.

17. The data-driving apparatus of the electro luminescence display panel as claimed in claim 15, wherein constant current switching device and the constant current supply switching device are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

19. The data-driving apparatus of the electro luminescence display panel as claimed in claim 14, wherein said first to third switching devices are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

20. The data-driving apparatus of the electro luminescence display panel as claimed in claim 14, wherein said fourth and fifth switching devices are p-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

22. A data-driving apparatus of an electro luminescence display panel, comprising:

a display panel including a plurality of scan electrode lines and data electrode lines crossing each other, and a



plurality of electro-luminescence cells including a current mirror circuit and emitted by a current;

a plurality of current source type data drive integrated circuits including a plurality of current source type data drivers for supplying the data to the display panel on the basis of the constant current, a first switching device connected between a first voltage source and the ground voltage source, a second switching device supplied with the first voltage source, and for forming a current mirror circuit with the first switching device, a third switching device connected between the second switching device and a ground voltage source, and controlled by a current controlling signal supplied by way of the second switching device, a fourth switching device formed a current mirror circuit with the third switching device to output a reference current, a fifth switching device formed a current mirror circuit with the third switching device to supply a reference current to the data driver; and

the reference current from the fourth switching device is accessorially supplied to the data drive integrated circuits, and the reference current supply/path part is formed at one side of the data drive integrated circuit.

23. The data-driving apparatus of the electro luminescence

display panel as claimed in claim 22, wherein said first and second switching devices are p-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

24. The data-driving apparatus of the electro luminescence display panel as claimed in claim 22, wherein said third to fifth switching devices are n-type Metal Oxide Semiconductor Field Effect Transistor MOSFET's.

26. The data-driving apparatus of the electro luminescence display panel as claimed in any one of claim 14 or claim 22, wherein said electro-luminescence cell includes:

- an electro luminescence device OLED emitted by a current;

- a sixth switching device formed between a ground voltage source GND and the electro luminescence device OLED for driving the electro luminescence device;

- a seventh switching device connected to the ground voltage source GND to form a current mirror with the sixth switching device;

- an eighth switching device connected the seventh switching device, the scan electrode line and the data electrode line to respond to a signal of the data electrode line;

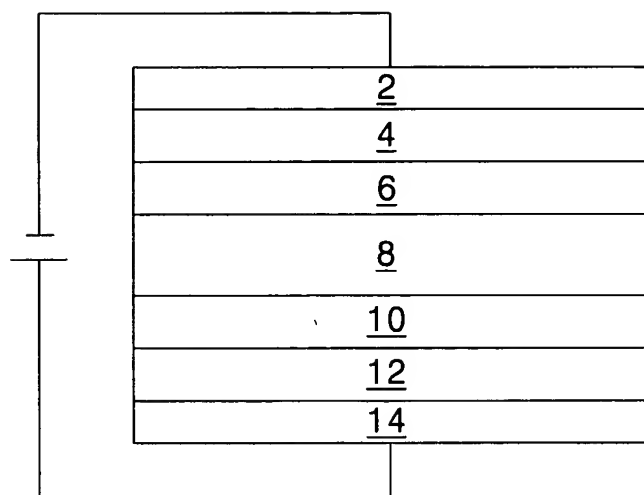
- a ninth switching device connected gate terminals of the

sixth and seventh switching devices, the data electrode line and the eighth switching device; and

a capacitor  $C_{st}$  connected between the ground voltage source GND and the gate terminals of the sixth and seventh switching devices.



FIG.1



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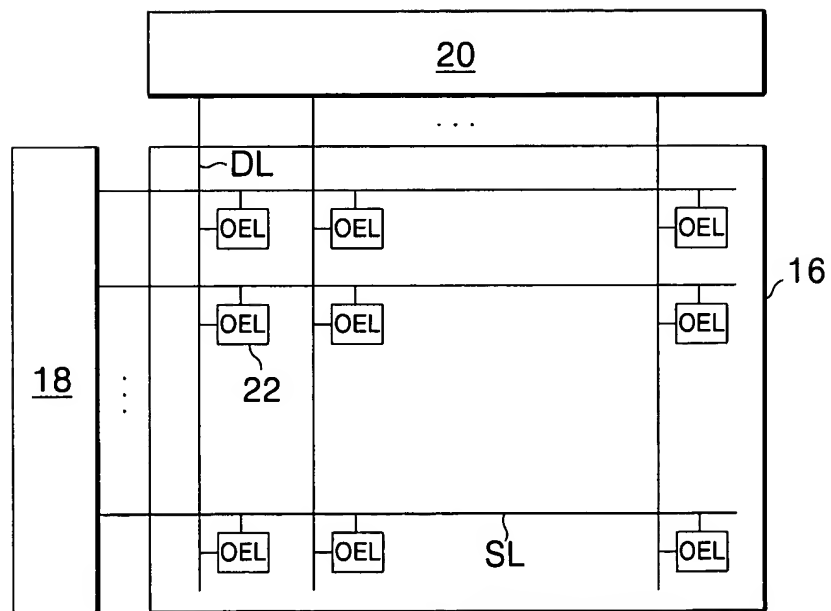


FIG. 3

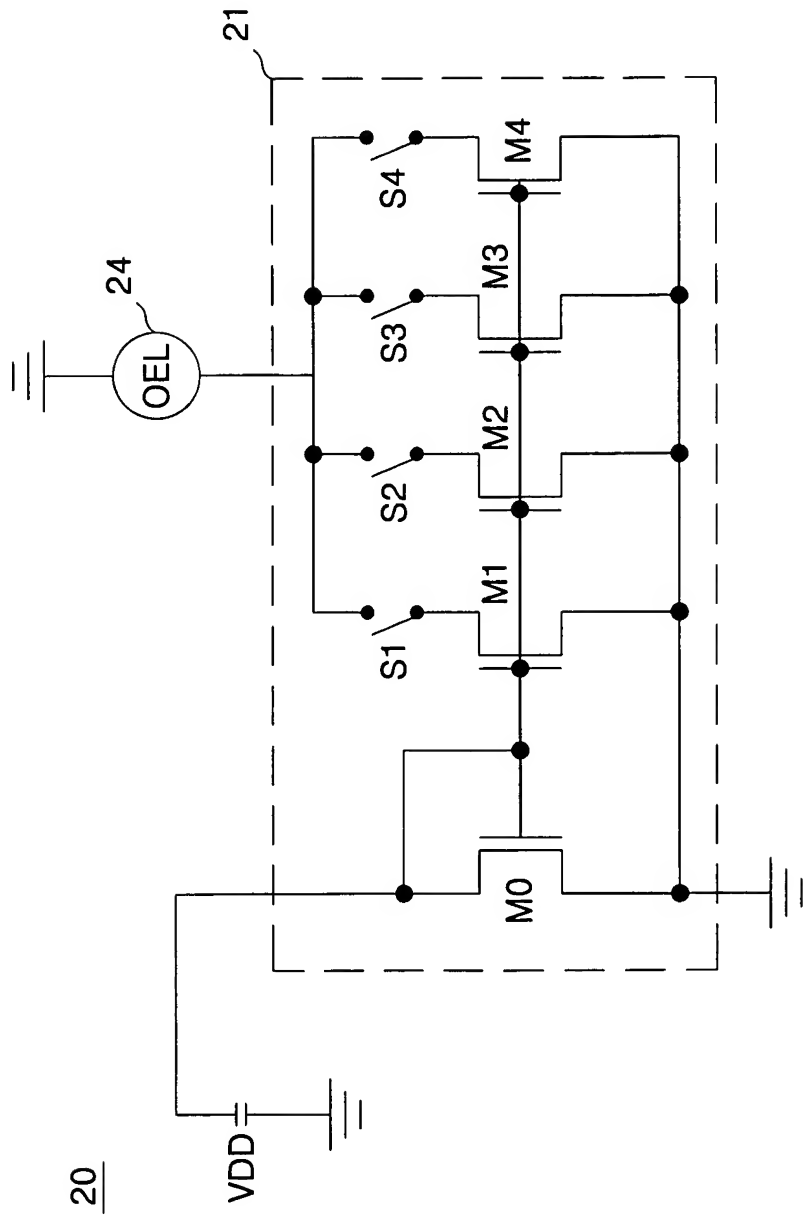


FIG. 4

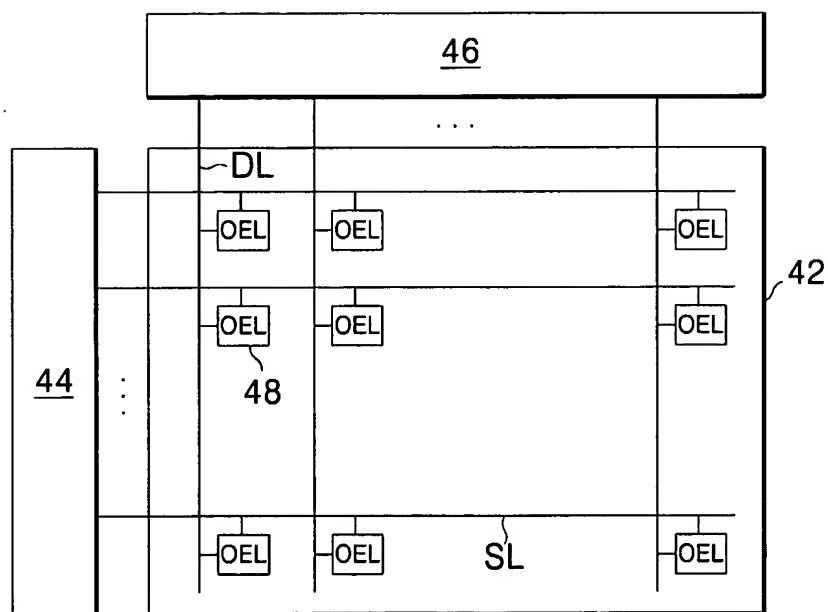


FIG.5

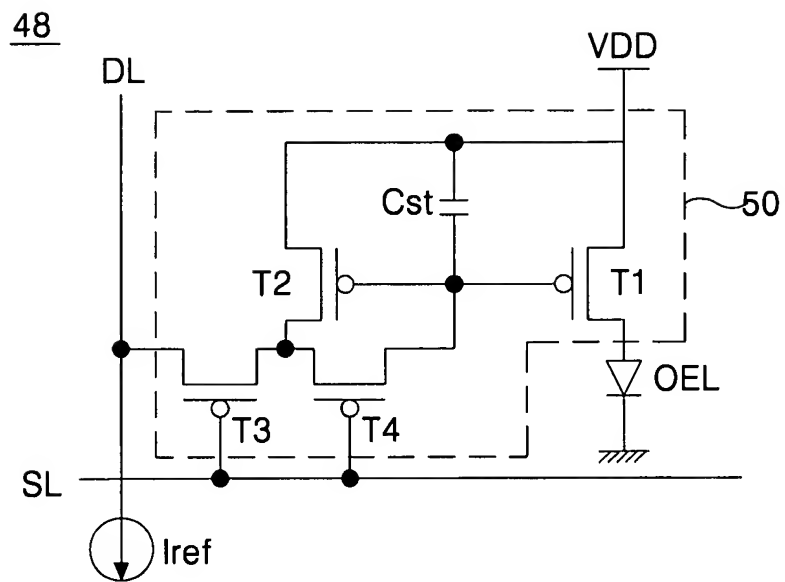




FIG.6

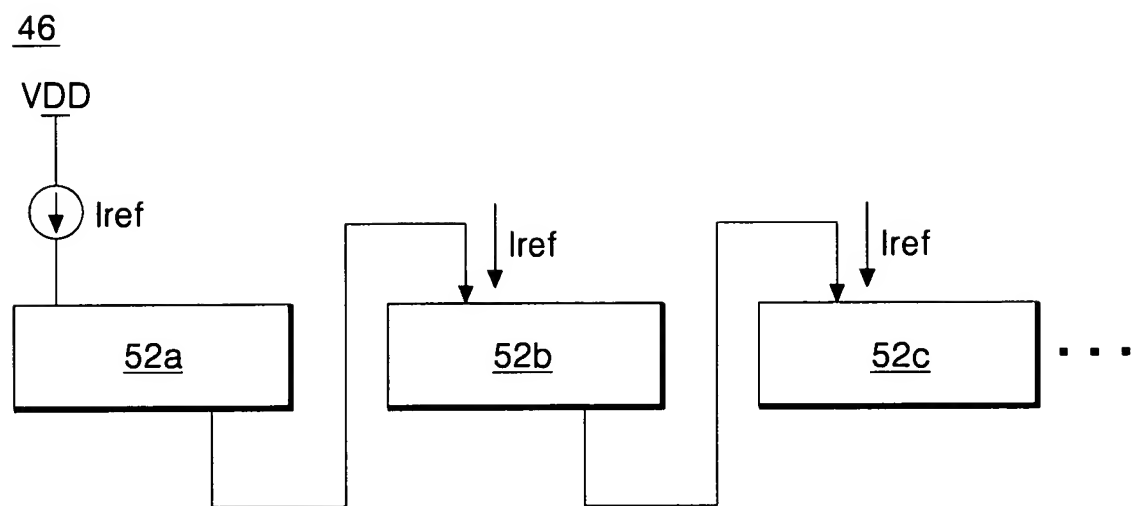


FIG. 7

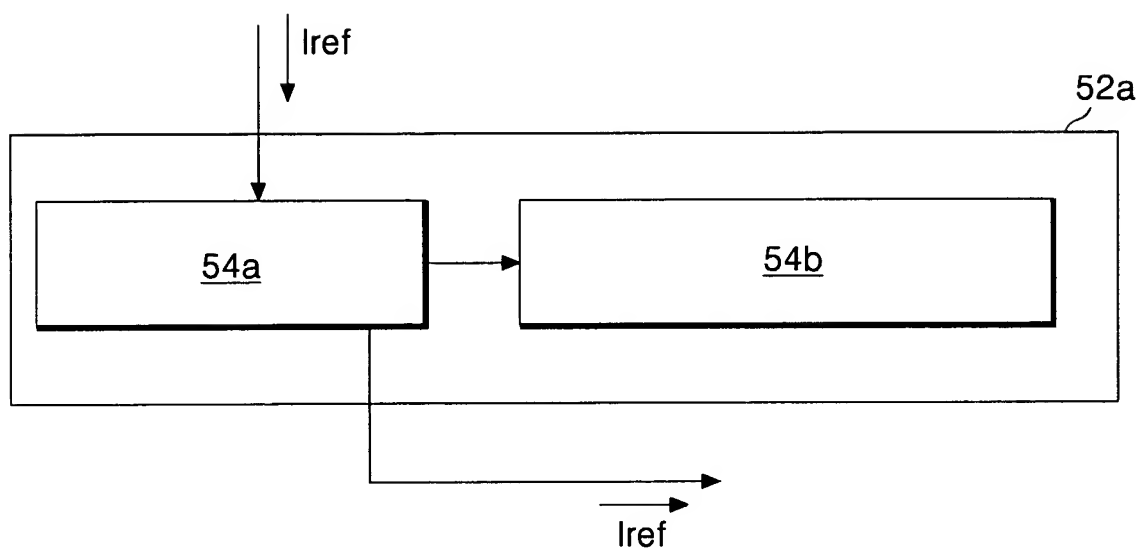


FIG. 8.

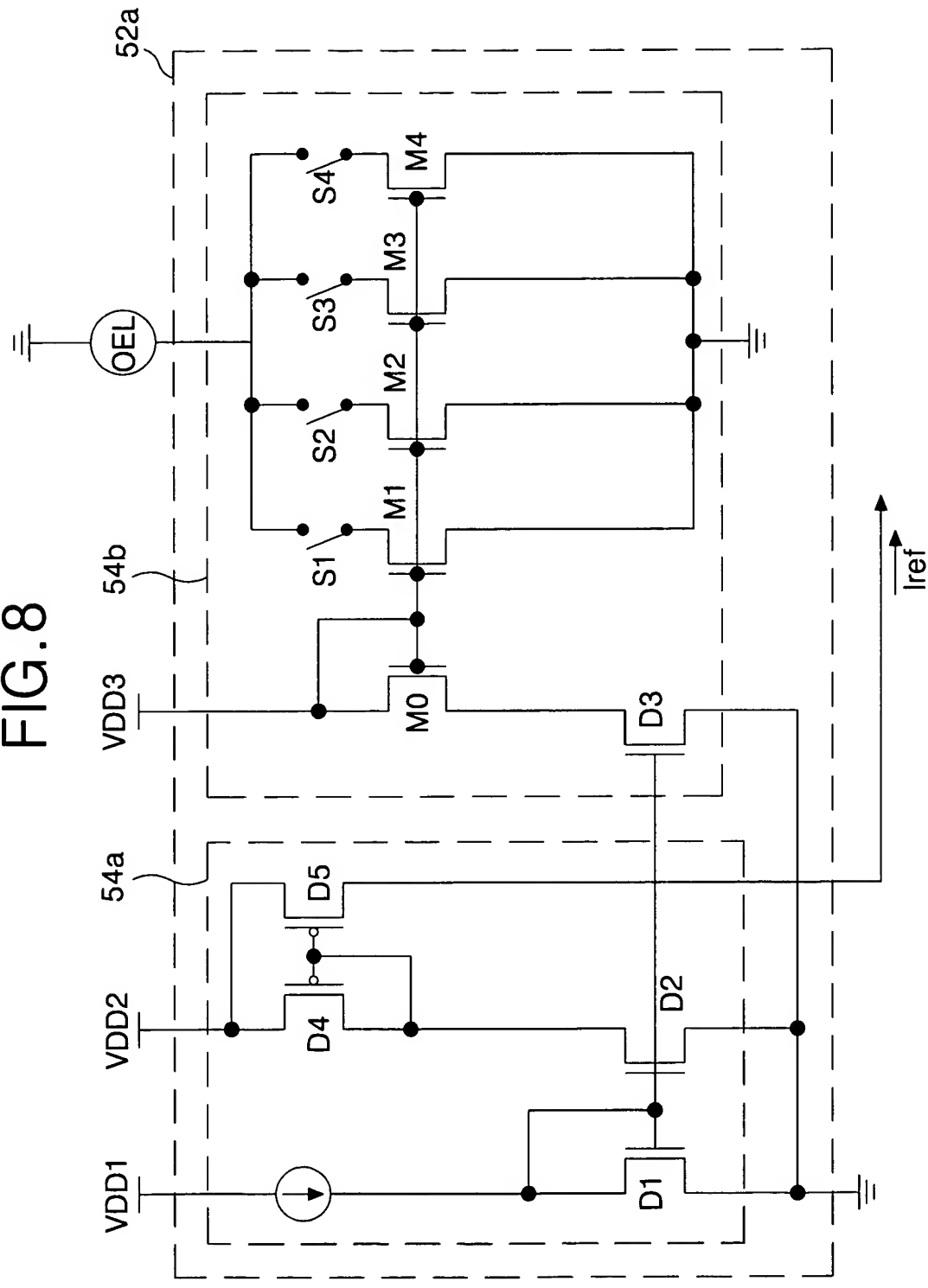


FIG. 9

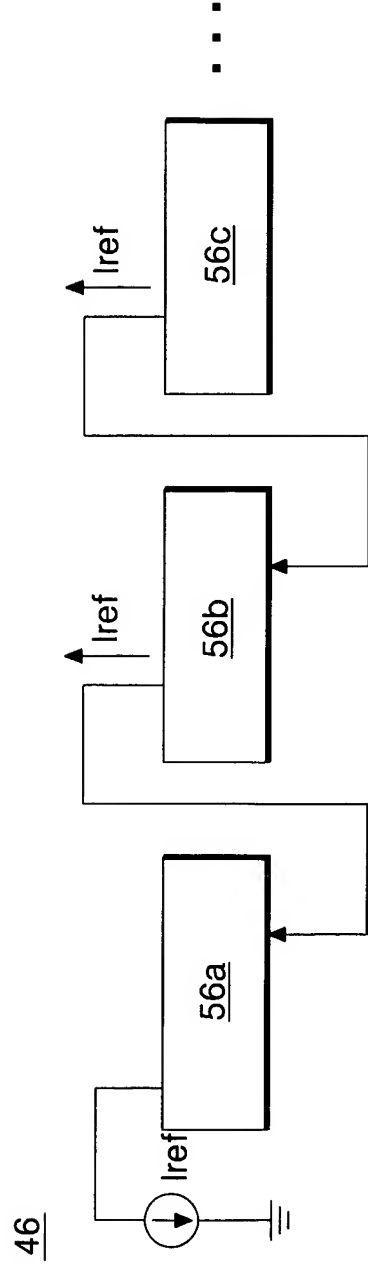


FIG. 10

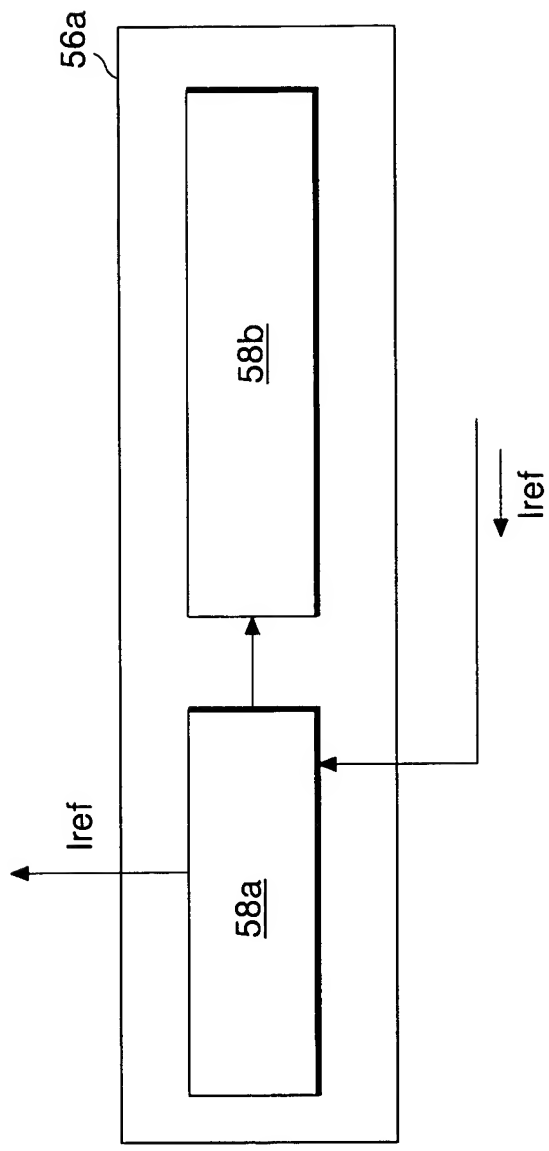
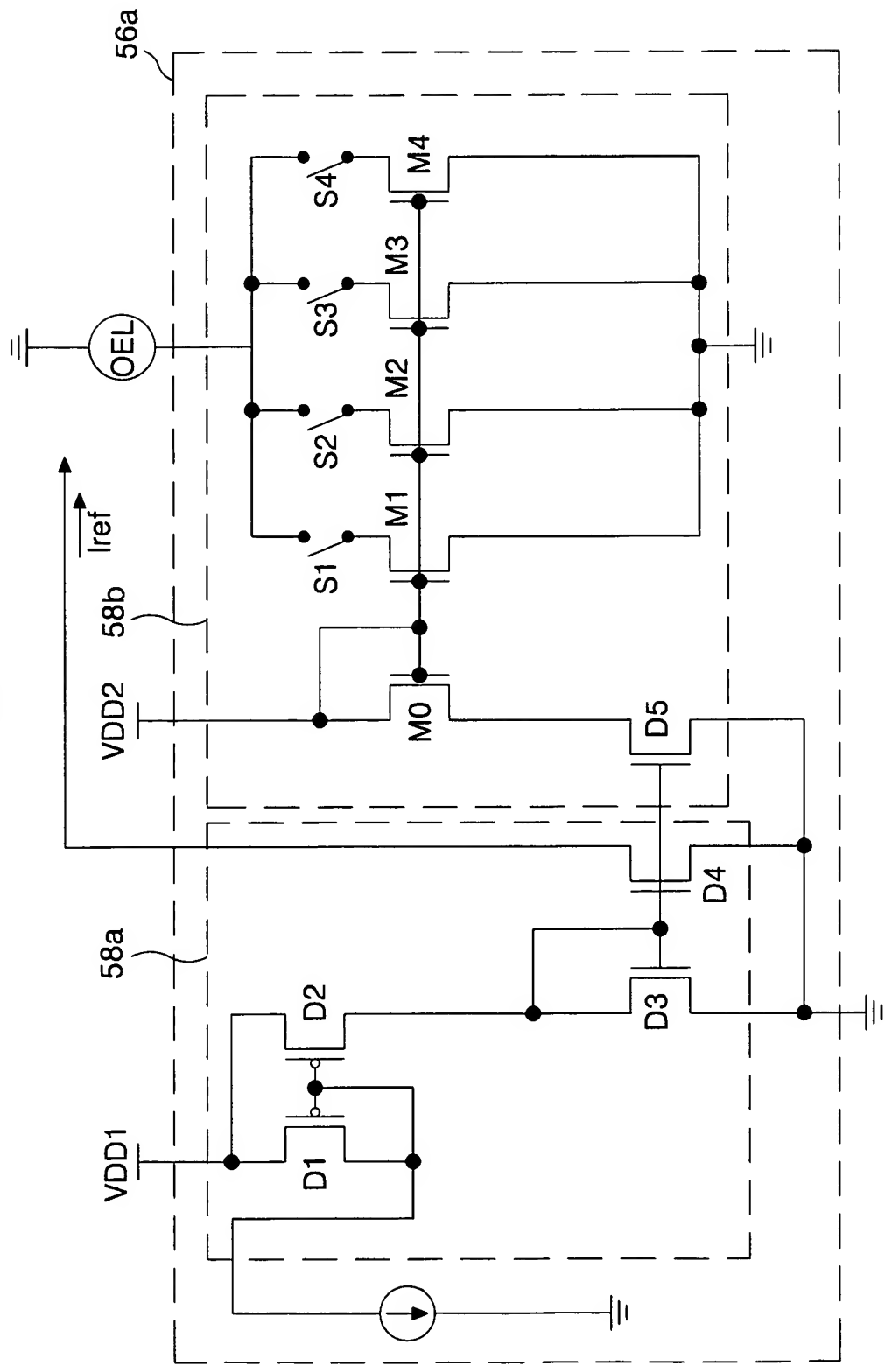


FIG. 11



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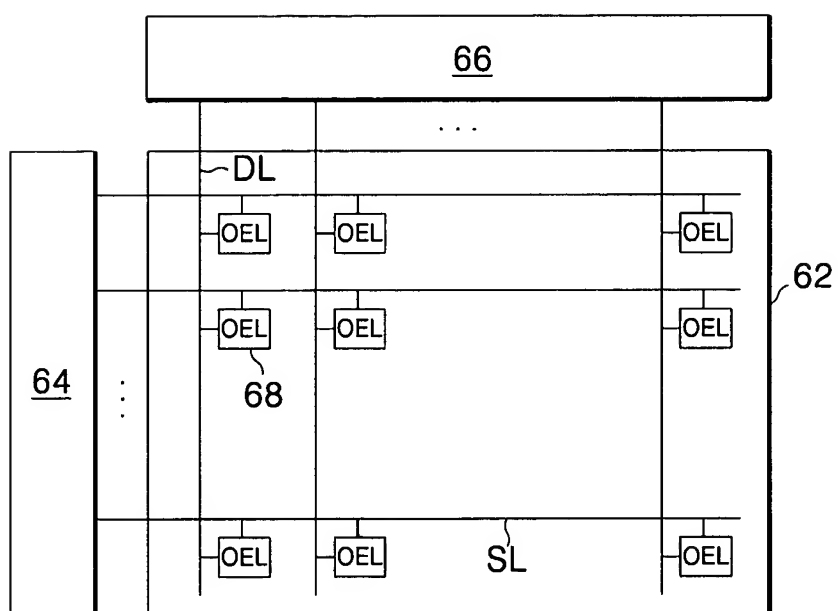


FIG.13

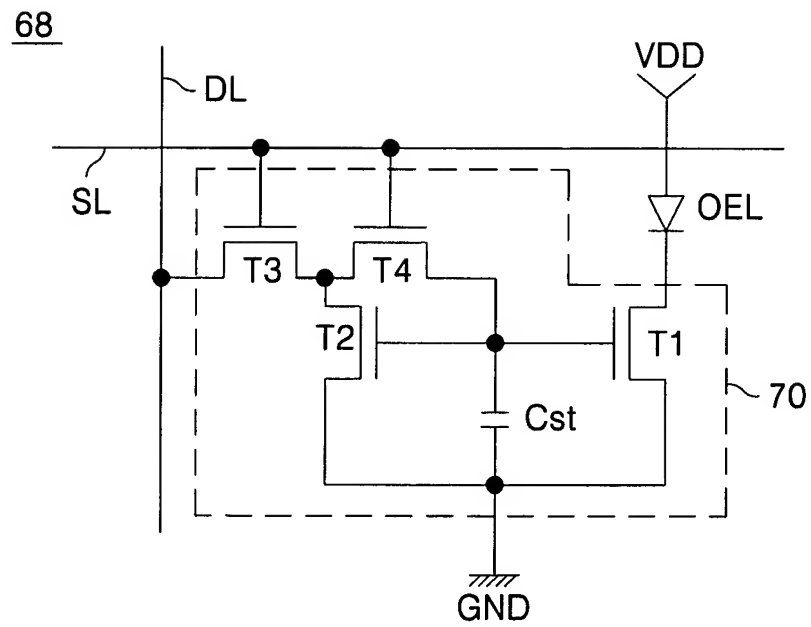




FIG.14

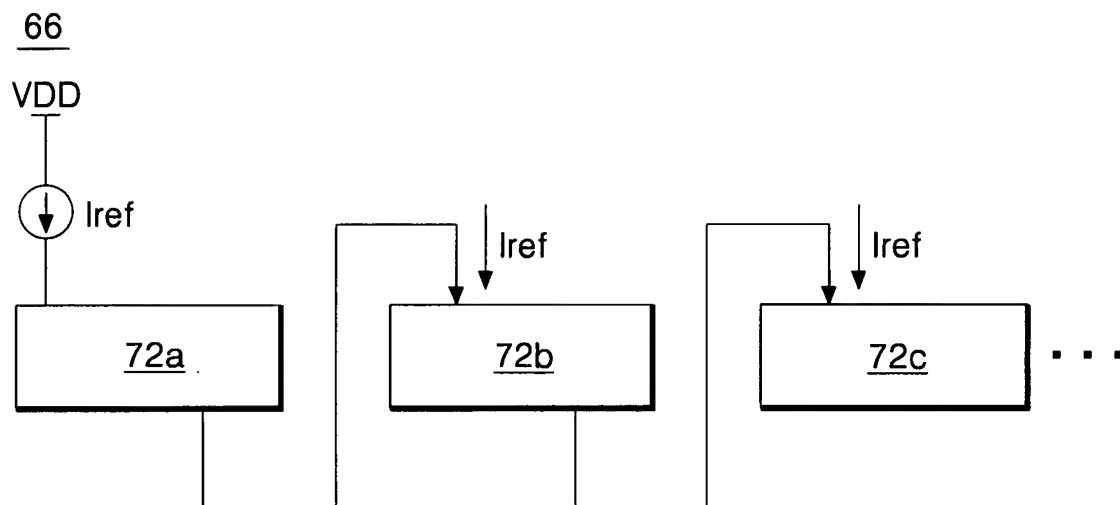


FIG.15

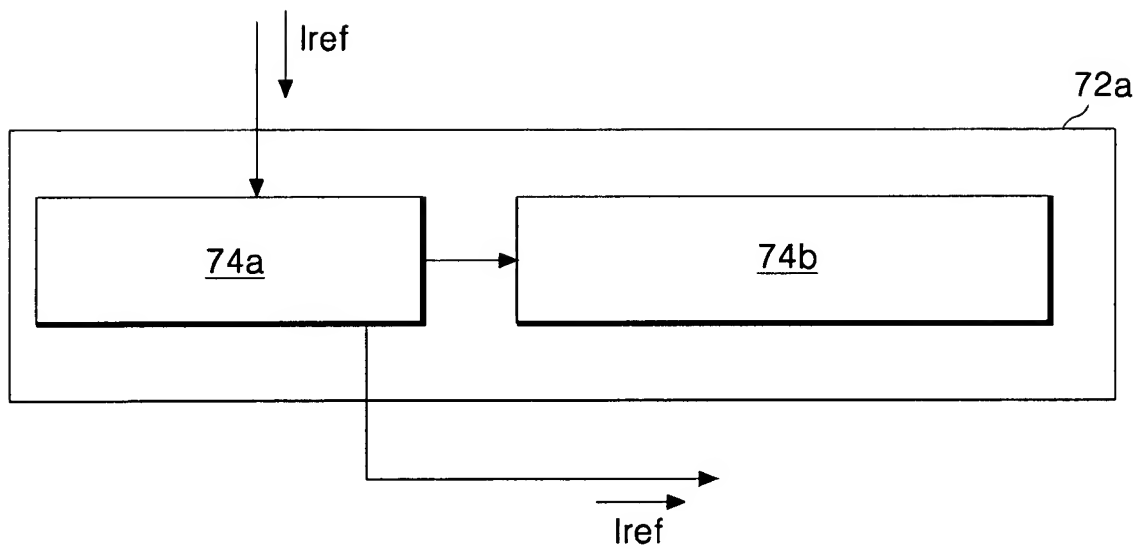


FIG. 16

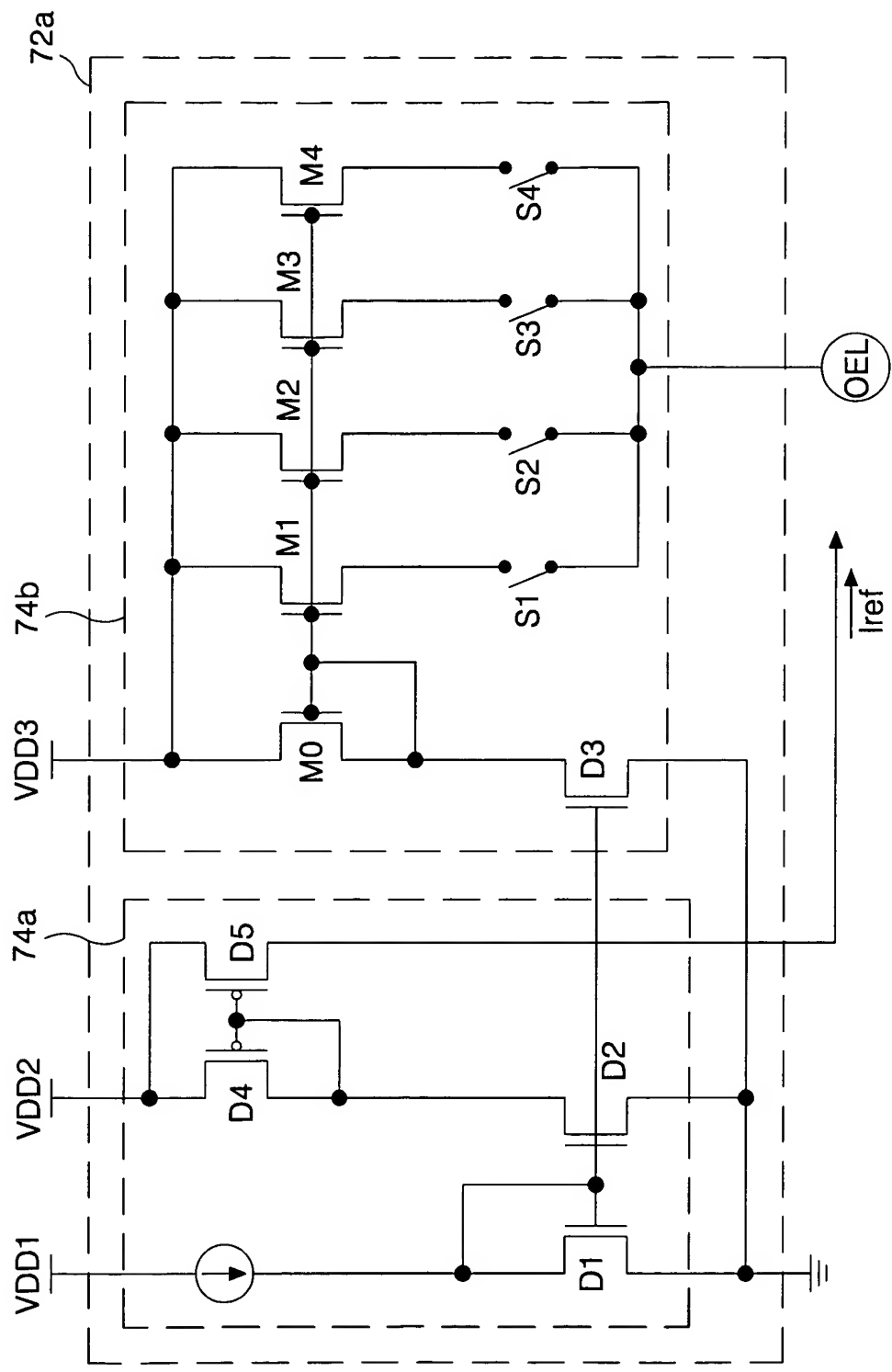


FIG. 17

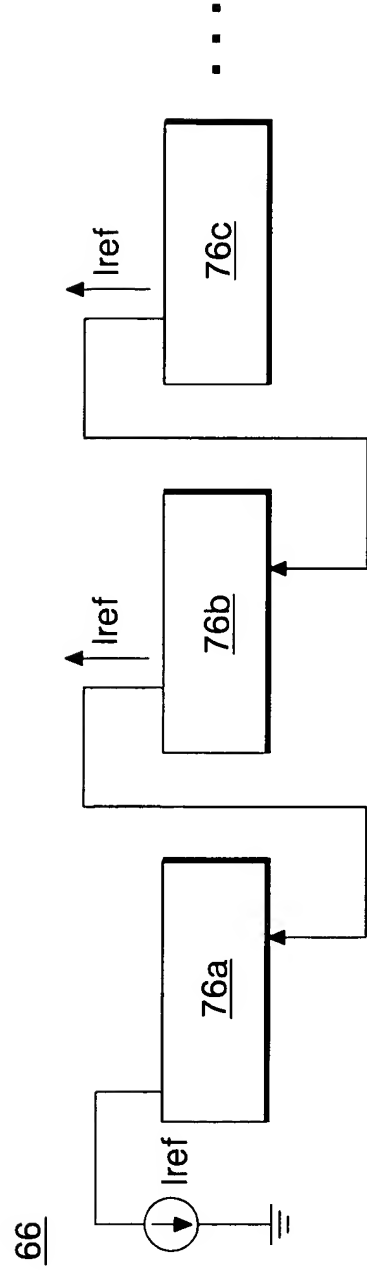
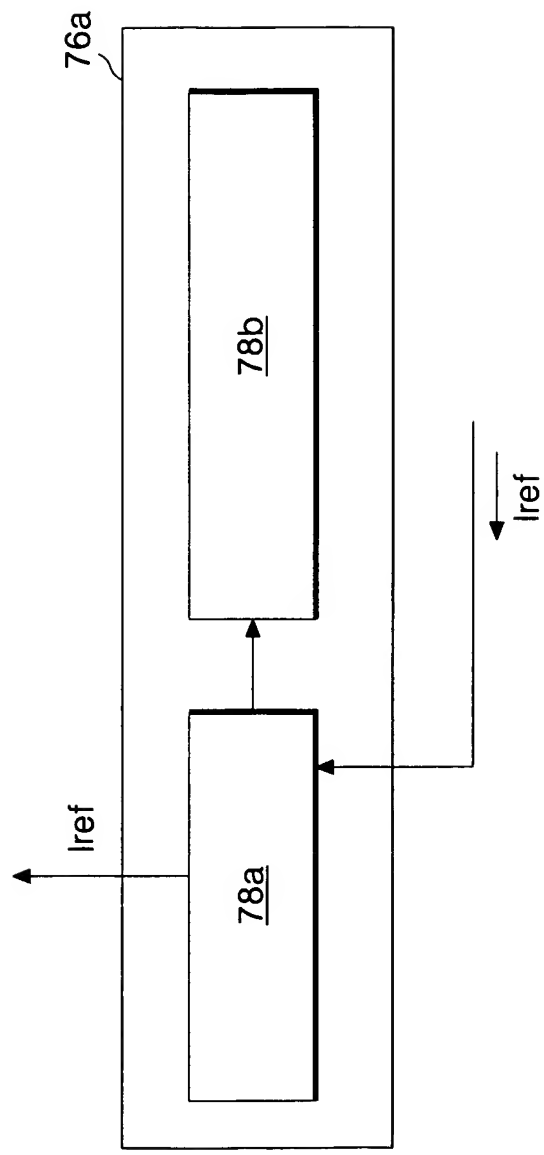


FIG. 18



61 62 63 64 65

